Early Iron Age pottery in south-western Iberia: archaeometry and chronology

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an archaeometry approach

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Early Iron Age pottery in south-western Iberia – archaeometry and chronology

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Abstract

Our current knowledge about the beginnings of the Early Iron Age in the south-western part of the Iberian Peninsula remains rather limited. The chronology and the nature of the first contacts between Phoenicians and Tartessians are among the unsolved issues plaguing the archaeology of Iberia's Early Iron Age. This paper argues that through systematic spectrographic analysis of pottery specimens from Tartessian sites (Setefilla and eleven other sites) it is possible to tackle these issues. Our methodology is based on both destructive and non-destructive analysis of ceramic samples. For the latter a highly sensitive portable X-ray fluorescence device is employed. The paper is also concerned with the strong need for a reliable ^{14}C-based chronology for the development of Tartessian material culture. A new approach for refining our chronological framework for this period is proposed that aims at providing us with a better grasp of the development of interactions and interdependences between the Phoenicians and the Tartessians over time.

Key-words: *archaeometry, pXRF spectrometry, chronology, Iron Age, Iberian Peninsula, western Andalusia*

Résumé

Nos connaissances sur les débuts de l'âge du Fer dans la partie sud-ouest de la péninsule Ibérique demeurent aujourd'hui encore plutôt insuffisantes. La chronologie et la nature des premiers contacts entre Phéniciens et Tartéssiens sont parmi les questions non résolues de l'archéologie de l'Âge du Fer en Ibérie. Ce travail démontre que, grâce à l'analyse spectrographique systématique des spécimens de poterie provenant de sites tartessiens (Setefilla et onze autres sites), il est possible de aborder ces questions. Notre méthodologie est basée sur l'analyse soit destructive, soit non destructive des échantillons de céramique. Pour ce dernier procédé, un dispositif de fluorescence à rayons X portable hautement sensible a été utilisé. Cet article aborde aussi l'importanceé d'une chronologie fiable basée sur des datations ^{14}C pour le développement de la culture matérielle tartessiénne. Une nouvelle approche permettant d'affiner le cadre chronologique de cette période est proposée, elle vise à fournir une meilleure compréhension du développement des interactions et interdépendances entre les Phéniciens et les Tartessiens au cours du temps.

Mots-clés: *archéométrie, spectrométrie pXRF, chronologie, âge du Fer, péninsule Ibérique, Ouest de l'Andalousie*

The purpose of this paper is to present a brief overview of an ongoing research project[1] on the beginnings of the Early Iron Age in the south-western part of the Iberian Peninsula. The start of the Iron Age is characterized by the presence of Phoenician traders on the Mediterranean and Atlantic coasts of ancient Iberia. Over the course of the last century, archaeological museums in Andalusia have accumulated an enormous body of wheel-made and hand-made Early Iron Age pottery. Unfortunately, our knowledge about relations between the Phoenicians and the locals is not increasing in proportion to the collected material evidence. Despite a long tradition of research on cultural contact in Iberia's Early Iron Age, basic problems still remain unsolved: the chronology and the nature of the first contacts between the Phoenicians and the native inhabitants of western Andalusia, the Tartessians.

[1] The project is financed by the Polish National Science Centre (grant number DEC-2013/09/B/HS3/00630).

The colonial impact on Tartessian society is often perceived as a unidirectional process in which the locals are passive consumers of imported goods. Such simplistic models go hand in hand with a lack of knowledge about patterns of long-distance trade between the Phoenicians and the locals. Currently, the origin of foreign artefacts found in local contexts in most cases remains uncertain (Fig. 1). To overcome theses problems, two informal research groups were established: one at Queen's University Belfast which will be responsible for the chronological part of the project, and the other at Adam Mickiewicz University in Poznań, working on archaeometric provenance determination of pottery.

To understand any historical process, a reliable chronological framework needs to be established first. Therefore, one of the objectives of the project is to create a reliable ^{14}C-based chronology for the Early Iron Age in south-western Iberia. This is to be achieved through a multi-disciplinary analysis of chronologically relevant data from the site of Setefilla, located in Seville province (Aubet 1975; 1978; Aubet *et al.* 1996). This site has been chosen because it was well excavated and provides a rich cultural assemblage, spanning most of the Early Iron Age, allowing us to combine site stratigraphy, seriation of grave assemblages and ^{14}C dating of cremated human bone to build a detailed chronological sequence that would be applicable also to other Tartessian sites. In particular, it offers the chance to distinguish between burials belonging to the precolonial phase of the indigenous LBA/EIA culture from later tombs that date to the phase of colonial contact with the Phoenicians. The

Figure 1. Main sites of the Lower Guadalquivir studied within the project (background: Google Earth).

fact that in 18 graves from different stratigraphical layers at the site Phoenician wheel-made pottery was found together with local grave goods provides an opportunity to tie in the development of indigenous material culture with a wider inter-regional sequence. Moreover, we are planning to also analyse samples from Cruz del Negro (Maier 1992; 1999) and Rabadanes (Pellicer, Escacena 2007), two further sites located in western Andalusia. According to conventional typo-chronology, all sites mentioned date to the beginning of the Early Iron Age. However, a better-founded and more precise chronology is urgently needed, to address questions concerning the development of the relationship between indigenous communities and newcomers from the Eastern Mediterranean.

Currently, the absolute chronology of the Late Bronze Age / Early Iron Age transition in SW Iberia to a large extent remains dependent on the dating of Eastern Mediterranean imports, mainly Phoenician pottery types, ultimately tethered to the historical chronologies of Geometric Greece and the Near East. This continues to hold true regardless of recent challenges to this model on the basis of new ^{14}C determinations from sites at both ends of the Mediterranean, and also regardless of the eventual outcome of the ongoing debate concerning the validity of the underlying historical chronologies (Brandherm 2006; 2008a; 2008b; Gilboa 2013; Toffolo *et al.* 2013).

What is really needed is a reliable chronology for indigenous settlements and their material culture that no longer depends on 'importing' dates from the Phoenician homeland or elsewhere. Only this will allow us to achieve a better understanding of the development of local communities and of their interaction with any new arrivals from the Eastern Mediterranean. A new basis for the dating of Phoenician imports on its own will do little to alleviate this continued need.

Consequently, the first objective of the present project consists in building a sound chronology for the Late Bronze Age and Early Iron Age in SW Iberia. This is to be achieved through multivariate analysis of chronologically relevant data from a number of key sites, mainly from Setefilla. Additional data will be drawn from other, broadly coeval sites in the Guadalquivir valley. This will allow us to obtain dates for pottery types poorly represented or altogether lacking at Setefilla, in order to minimize the effect of site-specific idiosyncrasies on our chronological model.

Our methodology to build a reliable chronological framework for the Late Bronze Age / Early Iron Age transition in SW Iberia draws on a number of recent advances in radiocarbon dating techniques: the potential to obtain reliable ^{14}C dates from cremated bone samples, enhanced AMS dating precision, and the use of advanced Bayesian statistics to model sets of radiocarbon dates based on known constraints. For the purposes of this project these constraints are provided by stratigraphic evidence and seriation data. It is expected that used in conjunction, these techniques will allow us to overcome some of the present problems posed by the shape of the calibration curve in the 750-400 cal BC range, the so-called 'Hallstatt plateau'.

Cremation cemeteries with poor preservation or recovery of organic matter other than cremated bone, such as Setefilla, in the past have been extremely difficult to date by scientific means, including radiocarbon dating. Suitable ^{14}C dating techniques only started to be developed from the late 1990s onwards (Lanting *et al.* 2001; Naysmith *et al.* 2007). Since then, radiocarbon measurement of bioapatite from cremated bone samples has become a recognized standard method, now routinely employed by a number of AMS research laboratories. This opens up new possibilities to refine our chronological framework for this period, with the aim of providing a better grasp of the development of interdependencies between the Phoenicians and the Tartessians over time. While the relative sequence of funerary assemblages from Setefilla could be established with reasonable confidence, suggestions regarding their absolute chronology vary widely. Thus the earliest burials from the site are dated to c. 800 BC or even more explicitly the late 9th century BC by some authors, while others would have them beginning only about a century later (Bendala 1992; Torres 1996; Beba 2008). This margin of uncertainty poses significant problems for the correct interpretation of social phenomena materialized in the archaeological record at Setefilla (Fig. 2). With a low chronology, a plausible

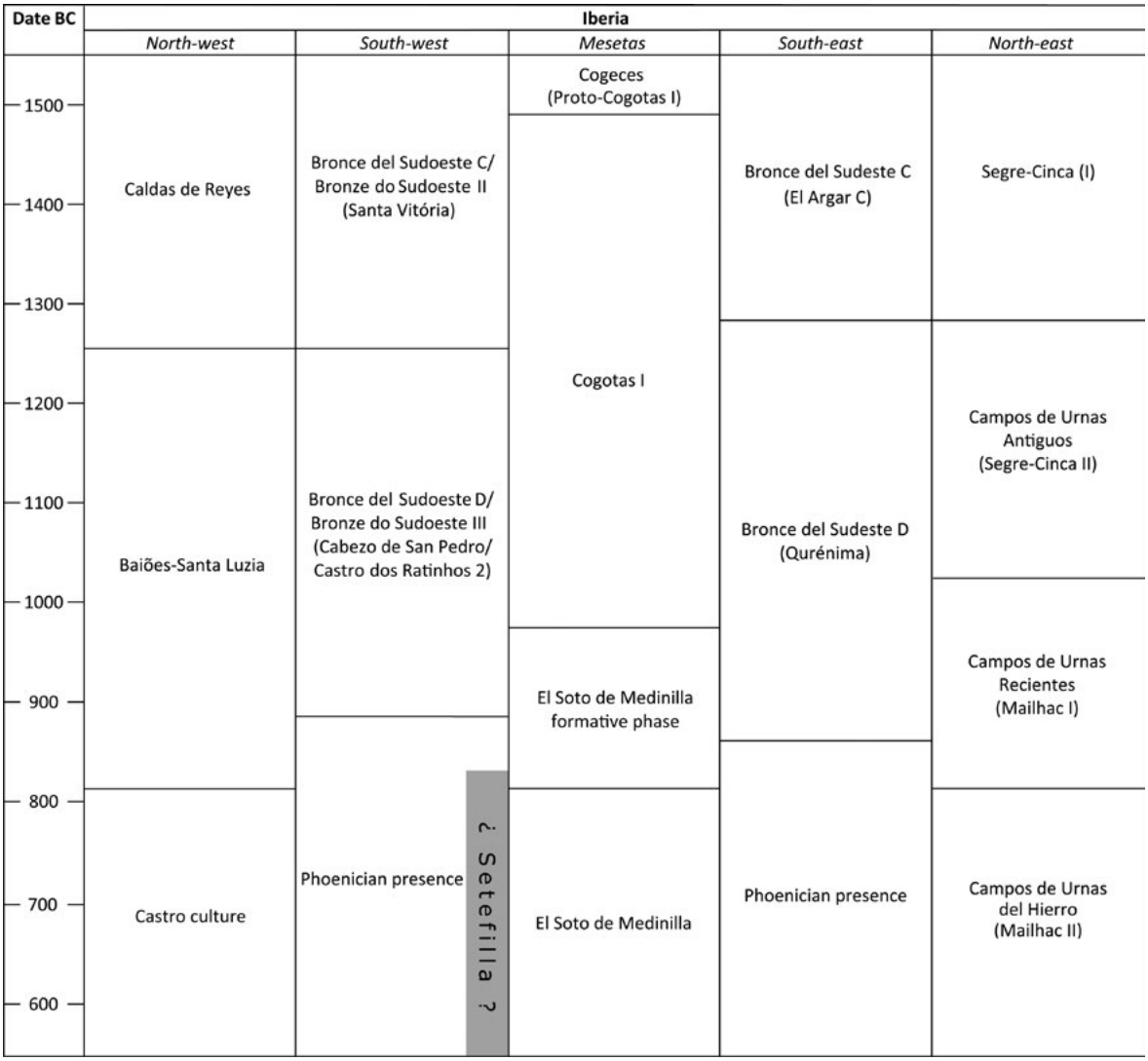

FIGURE 2. CHRONOLOGICAL RANGE FOR CREMATION BURIALS FROM THE SETEFILLA FLAT CEMETERY AND TUMULI A AND B PREVIOUSLY PROPOSED WITHIN THE IBERIAN LATE BRONZE AGE AND EARLY IRON AGE (MODIFIED AFTER ROBERTS *ET AL*. 2013, FIG. 2.5).

case could be made for viewing the reintroduction of archaeologically visible burial rites to southern Iberia in the Early Iron Age as inspired by Phoenician funerary practice, following a nearly total lack of evidence for either inhumation or cremation burials during the Late Bronze Age. On the other hand, with the confirmation of an early date such a reading would likely become untenable, adding to increasing evidence for 'precolonial' indigenous burial practices from other parts of southern Iberia (González 2002; Lorrio 2008). The application of Bayesian statistics to radiocarbon dates from burial contexts at Setefilla is hoped to open up the way forward to establishing a more accurate and more reliable chronology against which the contours of social change during the Early Iron Age in this part of the Western Mediterranean may be outlined (Buck 2004).

A further obstacle which any attempt to establish a radiocarbon-based chronology for the period in question will have to overcome lies in the severe limitations imposed by the uniquely flat stretch in the calibration curve know as 'Hallstatt plateau'. Conventional approaches to calibration so far

have not been able to offer a satisfactory solution to this problem, but drawing on the evidence from Setefilla a possible workaround may be available.

Based on conventional estimates it is expected that the burial sequence at the site spans the 9th to 7th centuries BC. Both a steep section in the calibration curve towards the end of the 9th and continuing into the early years of the 8th century as well as a peak in the curve during the second half of the 7th century are not subject to the usual problems experienced with the 'Hallstatt plateau'. They should be easily identifiable in any sufficiently large series of high-precision radiocarbon determinations spanning this period, and would provide fixed points to which the rest of the Setefilla sequence can be anchored, based on a combination of stratigraphic evidence with seriation data (O'Brien and Lyman 1999). Seriation of grave assemblages from Setefilla will be conducted using the PAST software package (Hammer *et al.* 2001).

Finally, stratigraphic evidence and seriation data will also be used to inform Bayesian modelling of AMS dates from Setefilla. It is envisaged to model the dates using both uniform-phase and normal-distribution approaches, and to subsequently check the outcome from these against each other as well as against existing models (Blaauw 2010; Blaauw and Christen 2011). Despite the considerable challenges posed by the shape of the calibration curve for this period, it is expected that the application of Bayesian statistics to radiocarbon dates from Setefilla will open up the way forward to establishing a more accurate and more reliable chronology against which to outline the contours of social change during the Early Iron Age in this part of the Western Mediterranean.

The basic principles of this method can be considered well understood and have successfully been applied to data sets from the period in question on a number of occasions (Bronk Ramsey 2009a; Finkelstein and Piasetzky 2010). With archaeological data of a comparable nature to those from Setefilla – Scythian Early Iron Age barrows with multiple burials for which the outline of a stratigraphical sequence could be established – this method has already been shown the potential of overcoming at least some of the problems posed by the 'Hallstatt plateau' (Van der Plicht 2004).

The second objective of our project is to determine the provenance of allegedly imported pottery from Tartessian sites. The actual origin of these alleged ceramic imports has not yet been securely established, and identifying their role in regional exchange networks will prove crucial for a better understanding of Early Iron Age society. In recent years, new provenance studies conducted on Phoenician pottery from SW Iberia have provided us with a much better understanding of production centres and trade connections across the Mediterranean (Behrendt and Mielke 2011; Behrendt *et al.* 2012). However, the relevant research was very much focussed on material from 'colonial' Phoenician sites, which is why despite the considerable advances made in this field, most questions regarding exchange and interaction between the Phoenicians and indigenous communities remain unanswered. We argue that through systematic spectrographic analysis of pottery specimens it is possible to gain useful insights into the diachronic interdependencies between Phoenician colonies and indigenous settlements. The origin of pottery is conventionally determined according to its morphological features. However, considerable uncertainty still persists in such determinations. Luxury products like wheel-made cups or plates could have been imported from the Levant, from the Phoenician colonies or produced locally. By using archaeometric techniques, a better understanding of regional production patterns and exchange networks can be achieved. The methodology is based on both destructive and non-destructive analysis of ceramic samples. Thanks to a highly sensitive, portable X-Ray Fluorescence analyser (Fig. 3) we expect to be able to establish the origin of raw materials used in the making of this pottery and therefore reveal whether wheel-made vessels are long-distance imports or just result from a practice of imitation. As the reference database for the raw clays is in the process of being created by different archaeologists and geologists working in Andalusia, our main method to determine the origin of pottery is the definition of fabric groups based on statistics. Statistical analysis of the results from nearly 300 samples permits to mark out groups with different chemical composition. Although at this stage we are not able to establish the exact provenance of every

FIGURE 3. THE XRF SPECTROMETER IN THE FACULTY OF CHEMISTRY OF THE ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ (PHOTO: M. KRUEGER).

sherd, it is feasible to identify singular groups of possible foreign origin. It should be added that field XRF analysis of raw clays was undertaken in the surroundings of Setefilla, our key site.

pXRF analysis is a non-destructive method which permits to identify the chemical composition of a wide range of materials and does not require any extraction of samples, enabling analysis on-site in museum storage rooms, which eliminates problems of access to collections, the need for sample-export permits, and significantly reduces total project costs. The use of pXRF units is becoming more and more common in archaeology. The significance of pXRF analysis in archaeometry is unquestionable: it preserves the physical integrity of artefacts, enables access to large data sets and ensures the capability for rapid analysis (Goren *et al.* 2011; Shackley 2011; Forster *et al.* 2012; Bonizzoni *et al.* 2013). Above all, this method is extremely useful for providing information on the production and exchange of ancient ceramics (Ownby 2012). However, it is not the only technique used in the archaeometric part of the project. Low-tech fabric analysis will be conducted as a complementary technique in order to determine fabric groups. In this approach, invented in the 1960s at Leiden University, there is no need to use advanced equipment, nor specific 'know-how' (Franken and Kalsbeek 1969). Using this technique, the surface of the samples is polished by using sandpaper. The flat surface of a sample then permits to carry out further steps, i.e. optic microscope analysis and the identification of inclusions, porosity and matrix of the clay.

In the case of Tartessos, the results of the provenance study will provide crucial information, allowing us to better understand the economic structure of the Tartessian region at the beginning of the Iron Age in SW Iberia. For the purposes of the project, a Bruker Tracer III SD spectrometer has been purchased. The use of the same type of instrument and similar measurement protocols employed by other teams working in the region will provide inter-project consistency, avoiding problems otherwise expected from the use of varied equipment and techniques. Over the last couple of years, a German team has started working on determining the provenance of Phoenician pottery from ancient Iberia, conducting a project entitled 'Archaeometric Investigation of Phoenician Pottery from the Iberian Peninsula' (Behrendt, Mielke 2014). Their research, however, is aimed at answering different questions and primarily studies pottery from coastal Phoenician sites rather than from inland indigenous contexts. Our project, at the moment focused on sites in the Guadalquivir valley, will complement this research.

Apart from non-destructive investigations, laboratory analysis of a test sample will be conducted as well, in order to cross-check results. Using pXRF to analyse ceramic samples with already known composition is the standard approach in this type of research. The destructive analysis of strong

acids decomposition will be conducted at Adam Mickiewicz University using atomic spectrometers (atomic absorption analysis and the new analytical technique of microwave-induced plasma atomic emission spectroscopy). Thanks to multivariate data analysis it will be possible to establish whether the analysed artefacts are of local origin or not. It is expected that this will provide us with new insights into the network of interconnections that existed between Phoenicians and indigenous communities. The results of the large-scale provenance study undertaken as part of the present project will provide crucial information, allowing us to better understand the economic structure of our study area at the beginning of the Iron Age. Apart from being of crucial importance for the identification of economic networks, this research will also have considerable impact on our understanding of the political and social organization of indigenous Early Iron Age communities. New interpretive models place considerably less emphasis on the role of centralized power and elite control in the transformation of indigenous society following contact with the Phoenicians than has previously been the case, and instead shift focus on the agency of commoner households (Delgado 2013).

As the investigations are still in the initial stage, no results from the project are available at the moment. Therefore, we can only provide some preliminary information on our sampling strategy. Sampling was carried out during the summer of 2014 in three Andalusian institutions: in the Archaeological Museum in Seville, in the University of Seville and in the Casa-Museo Bonsor in Mairena del Alcor. Pottery from 20 Tartessian sites located in western Andalusia, mainly in the Guadalquivir valley were analysed by a portable XRF spectrometer. In total, 860 analyses were conducted directly in the relevant museums. Where possible, pXRF readings were taken on a broken edge. Where this was not feasible, the surface of the sherd was always cleaned prior to analysis. Special attention was paid not only to so-called Phoenician pottery, but also to items normally perceived as local, like *á chardón* and Cruz del Negro type vessels. What is more, 49 samples for destructive analysis were obtained from Setefilla, due to the significance of this site in establishing an accurate chronological framework. The link between chronology and chemical composition is the reason why the pottery from Setefilla has been chosen as the main reference group for further spectroscopic analysis of pottery from other Tartessian sites. At present, a data base of the archaeometric information is being prepared and the statistical analysis of the data will be carried out soon to obtain provenance classification. The results will be compared with the outcome of work undertaken by the German team.

In conclusion, we are hoping to integrate the analysis of samples from Setefilla and imported objects in a comprehensive analysis of the material culture within the social and territorial organization of the Lower Guadalquivir region. The planned research could shed completely new light on the beginning of the Iron Age in SW Iberia. The ongoing investigations will have important implications for our understanding of the development of this region during the transitional period between the Late Bronze Age and Early Iron Age, when for the first time indigenous communities were exposed to new social and economic models originating from the Eastern Mediterranean. Solving the problem of the origin of 'imported' items by determining their chemical composition and the problem of chronology through AMS dating can mark a significant breakthrough in our understanding of historical transformations in south-western Iberia.

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